APPENDIX: THE EFFECTS OF MANAGED CARE ON USE OF SERVICES: EVIDENCE FROM NATIONAL SURVEY DATA

A number of studies indicate that enrollees in health maintenance organizations (HMOs) use fewer services than similar patients in indemnity plans, with little or no adverse effect on health. Some of the studies also appear to show that the independent practice association (IPA) form of HMO is as effective as the group/staff model. The primary distinction between these two forms is that physicians in IPAs treat a mix of HMO and fee-for-service patients, while those in group/staff models treat only patients enrolled in their HMO. The group/staff models are generally thought to be more tightly managed, and thus more effective at controlling use and costs.

Although there is some evidence that well-managed IPAs can control use of services as well as group/staff HMOs, data from national surveys indicate that, on average, use of services by IPA enrollees is only slightly lower than it is for indemnity patients. Average use of services by enrollees in group/staff HMOs, however, is substantially lower than use by either indemnity or IPA patients.

This memorandum uses data from the 1992 National Health Interview Survey (NHIS) to estimate the average effects of group/staff HMOs and IPAs compared with indemnity plans in the fee-for-service sector. It updates and revises earlier results reported by Lewin-VHI, based on the 1989 NHIS.[1]

The estimates show that average use of medical services by patients in group/staff HMOs is about 20 percent lower than that of similar patients in indemnity plans, and use by patients in IPAs is about 1 percent lower. Weighting the effects for group/staff HMOs and IPAs by 1992 year-end HMO enrollment indicates that, when compared with indemnity plans, the current mix of HMOs reduces use of services by an average of 7.8 percent.[2] These HMO effects are about twice as large as those found by Lewin-VHI. One reason for the larger effects is that CBO used information about whether or not a respondent gave birth in the hospital at any time during the year, whereas Levin-VHI did not. Thus, the Lewin-VHI study did not control for an

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1. Lewin-VHI, Inc., *The Financial Impact of the Health Security Act, Appendix A* (Fairfax, Va.: Lewin-VHI, Inc., December 9, 1993), Table A-4; and Lewin-VHI., Inc., "Effects of Managed Care, Uninsurance, and AIDS on Health Care Use" (Fairfax, Va.: Lewin-VHI, Inc., February 15, 1993).

2. In 1992, an estimated 63 percent of HMO enrollees were in IPAs (including network plans) and 37 percent were in group/staff HMOs. See Group Health Association of America, *Patterns in HMO Enrollment* (Washington, D.C.: Group Health Association of America, 1993).

important source of adverse selection affecting HMOs--the preference of many people planning a pregnancy to insure through an HMO because of the relatively generous maternity and well-baby benefits that HMOs typically provide.

Data and Methods

The data used for this analysis were taken from the 1992 National Health Interview Survey conducted by the National Center for Health Statistics, which included a health insurance supplement that describes the type of insurance plans each respondent had.[3] The NHIS is an annual survey of about 130,000 individuals from about 50,000 households that are representative of the civilian noninstitutional population of the United States.[4]

The sample used here included all NHIS respondents who at the time of the survey were less than 65 years old, had private insurance coverage, and did not have public insurance (Medicare, Medicaid, or other publicly assisted medical coverage). Those who met the criteria but did not know whether their insurance plan was an HMO or not were excluded. The resulting unweighted sample included 47,822 people.

CBO estimated two sets of multivariate regression equations--one to explain respondents' use of outpatient medical visits during the 12 months before the survey, and the other to explain their use of hospital inpatient days. In each case, CBO used two equations to explain respondents' use of services--logistic regression to estimate the probability that the respondent had any use (one or more outpatient visits, or one or more inpatient stays) during the year, and ordinary least squares regression to predict the amount of use (number of outpatient visits for those with any visits during the year, or number of inpatient days for those with at least one hospital admission). The predicted probability of any use multiplied by the predicted amount of use for users gives an estimate of the total amount of use for a respondent with a given set of characteristics.

The explanatory variables used here were the same for each of the four regression equations, and all were coded as sets of categorical, or "dummy," variables. The set of greatest interest is the one describing the primary health

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3. Respondents were asked to classify their plans by type, but were also asked to identify the plans by name. Plan names were used later to verify and, if necessary, correct the plan type given by the respondent.

4. The overall response rate to the health insurance supplement for the National Health Interview Survey was about 92 percent.

insurance plan that respondents had at the time of the survey. Three HMO categories were specified--a group or staff HMO, an IPA, and an HMO of unknown type. The remaining insurance category contained all non-HMO plans, which would include both unmanaged and managed indemnity plans, such as those with utilization review programs or with preferred provider organizations (PPOs). A number of additional categorical variables were included to control for factors other than insurance that might affect respondents' use of medical services. They included variables for delivery of a child during the year, race, age, sex, health status, education, income, region, and urbanization of the respondent's residence.[5]

The estimated coefficients were obtained using unweighted data, but the implications of the regressions were calculated using weighted means to reflect the characteristics of the insured population.[6] Table A-1 lists the dependent and explanatory variables used here, with their definitions and weighted sample means. Tables A-2 and A-3 show the estimated coefficients for the four regressions, along with their levels of significance.

Results

Estimated results were obtained separately for outpatient and inpatient services. The dollar-weighted average of these separate effects was then used as an estimate of the overall effects of HMOs on use of services.

Outpatient Visits. The first column in Table A-4 shows the implications derived from the two regressions for use of outpatient visits. Compared with indemnity enrollees, enrollees in group/staff HMOs are 3 percent more likely to use some outpatient services, although the number of services per user is not appreciably higher than it is for indemnity enrollees. Combining the findings for the probability of use and the extent of use for users, the results indicate that group/staff enrollees typically use 3.2 percent more outpatient visits than similar indemnity enrollees. Although this effect is small, it is statistically significant--that is, the evidence is not consistent with the hypothesis that group/staff enrollees use no more outpatient visits than similar indemnity enrollees.

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5. A female respondent was identified as having given birth during the previous 12 months if her reported hospital inpatient days excluding stays for delivery differed from the total inpatient days reported.

6. Because the NHIS uses a complex survey sampling scheme rather than simple random sampling, it is necessary to use weighted data to produce representative estimates of the magnitude of events, but unweighted data produce reliable coefficient estimates.

TABLE A-1. VARIABLE DEFINITIONS AND WEIGHTED MEANS

Name of Variable	Definition	Mean
childbirth	1 if gave birth during year in hospital	0.013
[excluded]	1 if did not give birth	0.987
black	1 if black	0.096
[excluded]	1 if not black	0.904
ch00	1 if age is less than 1	0.015
ch 1-6	1 if age is 1 through 6	0.093
fe7-18	1 if female age 7 through 18	0.090
fe19-34	1 if female age 19 through 34	0.134
fe35-54	1 if female age 35 through 54	0.177
fe55-64	1 if female age 55 through 64	0.055
ma7-18	1 if male age 7 through 18	0.097
[excluded]	1 if male age 19 through 34	0.125
ma35-54	1 if male age 35 through 54	0.166
ma55-64	1 if male age 55 through 64	0.048
[excluded]	1 if reported health is excellent	0.454
hlth2	1 if reported health is very good	0.307
hlth3	1 if reported health is good	0.190
hlth4	1 if reported health is fair	0.041
hlth5	1 if reported health is poor	0.008
[excluded]	1 if years of family head's education is under 12	0.044
educ2	1 if years of family head's education is 12	0.303
educ3	1 if years of family head's education is 13 through 16	0.262
educ4	1 if years of family head's education is 17 or more	0.390
[excluded]	1 if family income is under $35,000	0.331
midncome	1 if family income is between $35,000 and $50,000	0.224
hincome	1 if family income is $50,000 or more	0.325
unkncome	1 if family income is unreported	0.120
[excluded]	1 if residence is in Northeast	0.234
region2	1 if residence is in Midwest	0.258
region3	1 if residence is in South	0.278
region4	1 if residence is in West	0.230
[excluded]	1 if residence is an MSA-central city	0.273
msa2	1 if residence is an MSA-not central city	0.548
msa3	1 if residence is a nonfarm non-MSA	0.167
msa4	1 if residence is a farm non-MSA	0.012
grpstf	1 if primary health plan is a group or staff HMO	0.059
ipa	1 if primary health plan is an IPA	0.122
unkhmo	1 if primary health plan is an HMO, type unreported	0.220
[excluded]	1 if primary health plan is indemnity	0.599
inpuse	1 if respondent had any inpatient stays during year	0.058
ln (inpdays)	natural log of number of inpatient days for users	1.184
outpuse	1 if respondent had any outpatient visits during year	0.793
ln (outpvsts)	natural log of number of outpatient visits for users	0.974

SOURCE: Congressional Budget Office tabulations from the 1992 National Health Interview Survey.

NOTE: Except for the continuous dependent variables (inpdays and outpvsts), all are categorical, or "dummy," variables that have only two values--1 if the characteristic is present, and 0 if otherwise. Thus, the means show the proportion of people in the sample who have the specified characteristic.

TABLE A-2. REGRESSION ESTIMATES FOR OUTPATIENT VISITS

Explanatory Variable[a]	Logistic Regression for Probability of Any Visits: Estimated Coefficient	Logistic Regression for Probability of Any Visits: P-value[b]	Least Squares Regression for Number of Visits (Log Form): Estimated Coefficient	Least Squares Regression for Number of Visits (Log Form): P-value[b]
intercept	-0.189	0.0039	0.399	0.0001
childbirth	2.114	0.0001	1.319	0.0001
black	-0.096	0.0184	-0.154	0.0001
ch00	2.381	0.0001	0.671	0.0001
ch1-6	1.955	0.0001	0.336	0.0001
fe7-18	0.713	0.0001	0.032	0.1111
fe19-34	1.137	0.0001	0.257	0.0001
fe35-54	0.877	0.0001	0.196	0.0001
fe55-64	1.043	0.0001	0.195	0.0001
ma7-18	0.707	0.0001	-0.006	0.7581
ma35-54	0.056	0.1450	0.059	0.0017
ma55-64	0.485	0.0001	0.073	0.0043
hlth2	0.368	0.0001	0.234	0.0001
hlth3	0.548	0.0001	0.525	0.0001
hlth4	1.156	0.0001	1.021	0.0001
hlth5	1.857	0.0001	1.772	0.0001
educ2	0.395	0.0001	0.082	0.0003
educ3	0.639	0.0001	0.172	0.0001
educ4	0.842	0.0001	0.233	0.0001
midncome	0.067	0.0401	-0.014	0.2517
hincome	0.195	0.0001	-0.001	0.9372
unkncome	0.021	0.5794	-0.108	0.0001
region2	-0.125	0.0003	0.046	0.0004
region3	-0.209	0.0001	-0.041	0.0013
region4	-0.241	0.0001	0.029	0.0266
msa2	0.019	0.5042	0.016	0.1406
msa3	-0.086	0.0191	-0.004	0.7573
msa4	-0.183	0.0706	0.005	0.9129
grpstf	0.160	0.0019	0.001	0.9381
ipa	0.243	0.0001	0.041	0.0036
unkhmo	0.208	0.0001	0.037	0.0009

SOURCE: Congressional Budget Office regressions from the 1992 National Health Interview Survey.

a. See Table A-1 for definitions.

b. The lower the reported P-value, the stronger (or more significant) the relationship is. All variables with a P-value less than 0.05 are generally considered to be significant.

TABLE A-3. REGRESSION ESTIMATES FOR INPATIENT DAYS

Explanatory Variable[a]	Logistic Regression for Probability of Any Days: Estimated Coefficient	Logistic Regression for Probability of Any Days: P-value[b]	Least Squares Regression for Number of Days (Log Form): Estimated Coefficient	Least Squares Regression for Number of Days (Log Form): P-value[b]
intercept	-3.952	0.0001	1.098	0.0001
childbirth	9.837	0.0001	-0.140	0.0087
black	-0.073	0.3532	0.090	0.1124
ch00	1.351	0.0001	0.592	0.0001
ch1-6	-0.127	0.2788	-0.128	0.1881
fe7-18	-0.386	0.0025	0.007	0.9479
fe19-34	0.187	0.0620	-0.056	0.4698
fe35-54	0.375	0.0001	0.023	0.7464
fe55-64	0.459	0.0001	0.182	0.0356
ma7-18	-0.449	0.0005	0.264	0.0130
ma35-54	0.179	0.0585	0.133	0.0876
ma55-64	0.664	0.0001	0.282	0.0013
hlth2	0.405	0.0001	0.089	0.0434
hlth3	1.076	0.0001	0.203	0.0001
hlth4	1.854	0.0001	0.427	0.0001
hlth5	2.760	0.0001	0.828	0.0001
educ2	0.009	0.9276	-0.115	0.1035
educ3	0.147	0.1443	-0.031	0.6737
educ4	0.148	0.1472	-0.082	0.2643
midncome	-0.122	0.0540	-0.024	0.5921
hincome	-0.113	0.0767	-0.060	0.1906
unkncome	-0.215	0.0047	0.072	0.1832
region2	0.149	0.0223	-0.033	0.4748
region3	0.028	0.6644	-0.065	0.1613
region4	-0.214	0.0029	-0.146	0.0036
msa2	0.167	0.0033	0.033	0.4180
msa3	0.249	0.0005	0.073	0.1537
msa4	-0.023	0.9168	-0.189	0.2372
grpstf	-0.443	0.0002	0.010	0.8972
ipa	-0.059	0.4350	-0.015	0.7675
unkhmo	0.003	0.9590	-0.021	0.6085

SOURCE: Congressional Budget Office regressions from the 1992 National Health Interview Survey.

a. See Table A-1 for definitions.

b. The lower the reported P-value, the stronger (or more significant) the relationship is. All variables with a P-value less than 0.05 are generally considered to be significant.

TABLE A-4. ESTIMATED CHANGE IN USE OF SERVICES FOR HMOs COMPARED WITH TYPICAL INDEMNITY PLANS

	Percentage Change in Use		
	Outpatient Visits	Inpatient Days	Medical Services[a]
Probability of Any Use			
HMOs			
Group/Staff	3.0	-34.8	-20.1
IPA	4.5	-5.5	-1.6
Unreported	3.9	0.3	1.7
HMO Average[b]	3.9	-16.3	-8.4
Extent of Use Among Users			
HMOs			
Group/Staff	0.1	1.0	0.7
IPA	4.1	-1.5	0.6
Unreported	3.7	-2.1	0.2
HMO Average[b]	2.6	-0.6	0.7
Total Use of Services			
HMOs			
Group/Staff	3.2	-34.2	-19.6
IPA	8.7	-6.9	-0.8
Unreported	7.7	-1.8	1.9
HMO Average[b]	6.7	-17.0	-7.8

SOURCE: Congressional Budget Office estimates from the 1992 National Health Interview Survey.

NOTES: Typical indemnity plan refers to a fee-for-service plan with some elements of managed care. HMO = health maintenance organization; IPA = independent practice association.

a. Calculation of effects on use of medical services weights outpatient visits by 0.39 and inpatient days by 0.61, to reflect the mix of spending on outpatient and inpatient services.

b. Calculation of the HMO average uses weights of 0.37 for group/staff HMOs, 0.63 for IPAs, and 0 for HMOs of unreported type.

The increase in use of outpatient visits for other HMO enrollees, compared with indemnity enrollees, is 8 percent to 9 percent--and is thus larger than it is for group/staff enrollees. Further, the higher use among other HMO enrollees results as much from more visits per user as from a higher probability of any use, in contrast to the results for group/staff HMOs, in which most of the effect was due to a higher probability of any use during the year. The probability of any use is primarily the result of patients' preferences and would be expected to be higher among HMO enrollees because of the lower cost-sharing requirements typical in HMOs. The extent of use once a patient has initiated contact with the medical system, however, is a function of both the patient's preferences and the provider's responses. The difference between group/staff HMOs and other HMOs concerning the extent of use among users is indicative of the more effective control that group/staff HMOs apparently have over providers' treatment patterns.

Hospital Inpatient Days. The second column in Table A-4 shows the implications derived from the two regressions for use of inpatient hospital days. On average, the probability of an inpatient stay is about 35 percent lower for enrollees in group/staff HMOs than for similar people in indemnity plans. Among those who are admitted to the hospital, the number of days used is slightly (and not significantly) higher for group/staff HMO enrollees than for similar people in indemnity plans--perhaps because the much lower admission rate means that those who are admitted are sicker. Total use of hospital inpatient days is about 34 percent lower for group/staff HMO enrollees compared with similar people in indemnity plans.

The estimates indicate that IPA enrollees use about 7 percent fewer hospital inpatient days than similar people in indemnity plans, with most of this effect attributable to fewer hospital admissions. However, these effects are not statistically significant. In other words, these results are consistent with the hypothesis that IPAs, on average, do not reduce the use of inpatient days compared with indemnity plans.

Among HMO enrollees who do not know whether their plan is a group/staff model or an IPA, the estimated effects on use of inpatient days are even smaller. Compared with indemnity enrollees, this group uses about 2 percent fewer inpatient days. Here, too, the difference is not statistically significant.

Overall Use of Medical Services. The results discussed above are combined in the third column in Table A-4 to obtain an estimate of the effects of HMOs on the resource cost of medical services overall.[7] For this estimate, it is assumed that the

7. Nominal costs would include the effects of prices paid per service as well, but that is beyond the scope of this analysis. The NHIS does not include information on health care expenditures.

resource costs of all outpatient care are proportional to the number of outpatient visits made, and that the costs of all inpatient care are proportional to the number of inpatient days used. For the population under age 65 in 1987, about 39 percent of spending on insured services was for outpatient care, and 61 percent was for inpatient care.[8] These values are used to weight the results discussed above to estimate the effects of HMOs on the overall use of medical services. The estimates given here for overall use of medical services would probably be somewhat different if later expenditure data were available.

For each HMO group, use of outpatient services is somewhat higher than it would be for similar enrollees in indemnity plans, whereas use of inpatient services is lower. For group/staff HMOs, the combined effect on use of medical services overall is a substantial reduction of nearly 20 percent when compared with indemnity plans, because the reduction in inpatient use is large and the increase in outpatient use is small. For other HMO groups, small reductions in inpatient use are largely offset by increases in outpatient use of services, with little or no change in use of medical services overall. The average effect on overall use of medical services is a reduction of 7.8 percent.

Comparison with Other Research

Only one of the previously published studies that compares the effects of group/staff HMOs and IPAs with indemnity plans is based on nationally representative data. The other studies are based on selected plans, physicians, and patients that are not nationally representative.[9] Because it is inappropriate to conclude that the performance of HMOs in studies of selected plans is typical of all HMOs, this comparison focuses only on the nationally representative study by Lewin-VHI.

In addition to the different survey year examined (1989 instead of 1992), the methods used for the Lewin-VHI study differed from those used here in several ways. One important difference is that this analysis included an indicator for childbirth in the regressions, whereas the Lewin-VHI study did not. Other differences in specification that may have contributed to different results are that the

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8. Percentages are based on tabulations from the 1987 National Medical Expenditure Survey, the latest expenditure data available. Both outpatient and inpatient expenditures include facility, physician, and other professional costs.

9. For example, see Sheldon Greenfield and others, "Variations in Resource Utilization Among Medical Specialties and Systems of Care," *Journal of the American Medical Association*, vol. 267, no. 12 (March 25, 1992); and Randall Brown and Jerrold Hill, "Does Model Type Play a Role in the Extent of HMO Effectiveness in Controlling the Utilization of Services?" (Princeton, N.J.: Mathematica Policy Research, Inc., May 10, 1993).

Lewin-VHI study used only a single ordinary least squares regression to estimate total use of outpatient visits, instead of the two-part estimation procedure used here; further, it included uninsured and publicly insured people in the sample along with privately insured people, combined those in HMOs of unspecified type with those in IPAs, and estimated separate equations for children and adults.

For both group/staff HMOs and IPAs, the reduction in total use of services estimated here is about twice as large as the estimates reported by Lewin-VHI (see results for total use of services in Table A-4, in comparison with Table A-5). Group/staff HMOs reduce use of medical services by nearly 20 percent, instead of the 9 percent reduction implied by the Lewin-VHI results. IPAs reduce use by about 0.8 percent, instead of 0.3 percent. Averaged over both types, these estimates indicate that HMOs reduced use of services by nearly 8 percent in 1992, when compared with indemnity plans. By contrast, the Lewin-VHI results imply a reduction of 3.9 percent overall using the 1989 mix of HMOs, or a reduction of 3.6 percent using the 1992 mix.

When the explanatory variable for childbirth is excluded from the regressions in this analysis, the estimated reduction in use for HMOs overall is less than half the estimated drop when the childbirth variable is included (see Table A-6). The estimated reduction in use of inpatient services is only about half as large, while the increase in use of outpatient visits is slightly larger. Thus, excluding the childbirth variable produces estimates much closer to the results reported by Lewin-VHI. This probably indicates that the absence of a variable for childbirth in the data used by Lewin-VHI produced an estimate of HMO effects on reducing use of inpatient days that was too small, so the estimated effect on use of medical services overall was also too small.

TABLE A-5. PREVIOUS ESTIMATES OF CHANGE IN USE OF SERVICES FOR HMOs COMPARED WITH TYPICAL INDEMNITY PLANS

	Percentage Change in Use		
	Outpatient Visits	Inpatient Days	Medical Services[a]
Total Use of Services			
HMOs			
Group/Staff	6.6	-19.0	-9.1
IPA or Unreported	9.9	-6.9	-0.3
HMO Average			
As Reported[b]	8.4	-11.7	-3.9
Using 1992 Weights[c]	8.7	-11.4	-3.6

SOURCE: Congressional Budget Office, derived from Table A-4 in "The Financial Impact of the Health Security Act" (Fairfax, Va.: Lewin-VHI, Inc., December 9, 1993).

NOTES: Typical indemnity plan refers to a fee-for-service plan with some elements of managed care. HMO = health maintenance organization; IPA = independent practice association.

a. Results for medical services were not reported in the study, but were calculated from reported results for outpatient visits and inpatient days using 0.39 and 0.61 as the respective weights.

b. Calculation of the HMO average as reported uses (1989) weights of 0.41 for group/staff HMOs and 0.59 for other HMOs.

c. Calculation of the HMO average for 1992 uses weights of 0.37 for group/staff HMOs and 0.63 for other HMOs.

TABLE A-6. COMPARISON UNDER ALTERNATIVE SPECIFICATIONS OF ESTIMATED CHANGE IN USE OF SERVICES FOR HMOs COMPARED WITH TYPICAL INDEMNITY PLANS

	Percentage Change in Use		
	Outpatient Visits	Inpatient Days	Medical Services[a]
CBO Model with Childbirth Variable (Total Use of Services)			
HMOs			
Group/Staff	3.2	-34.2	-19.6
IPA	8.7	-6.9	-0.8
Unreported	7.7	-1.8	1.9
HMO Average[b]	6.7	-17.0	-7.8
CBO Model Without Childbirth Variable (Total Use of Services)			
HMOs			
Group/Staff	3.4	-23.5	-13.0
IPA	9.2	-1.9	2.4
Unreported	8.1	1.4	4.0
HMO Average[b]	7.0	-9.9	-3.3

SOURCE: Congressional Budget Office estimates from the 1992 National Health Interview Survey.

NOTES: Typical indemnity plan refers to a fee-for-service plan with some elements of managed care. HMO = health maintenance organization; IPA = independent practice association.

a. Calculation of effects on use of medical services weights outpatient visits by 0.39 and inpatient days by 0.61, to reflect the mix of spending on outpatient and inpatient services.

b. Calculation of the HMO average uses weights of 0.37 for group/staff HMOs, 0.63 for IPAs, and 0 for HMOs of unreported type.